



Date: September 22, 1982

Subject: Primary Processes R & D
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From/Location: E. L. Cambridge

To/Location: J. G. Kaufman

BASIC RESOURCES RESEARCH

Alumina Evaluation

Samples of Alpart, Kwinana and Reynolds Corpus Christi aluminas have been received and are being processed by Sample Preparation. One gallon samples are being split out to forward to Alcoa Labs for evaluation.

Bauxite Evaluation

XRF analysis for total Al_2O_3 , Fe_2O_3 , SiO_2 and TiO_2 shown significant deviations from standards. Additional samples have been submitted as a check. A report on evaluation procedures is being prepared.

AD-120 Process

a. Reductant Pre-treatment

An initial experiment with pre-treated higher S coke gave a high level of resulting C_xCl_y . Further experiments are planned to determine whether this result^x is^y typical or anomalous. Work continued to optimize the specific treatment conditions as a function of atmosphere and temperature.

b. Feedstock Pre-treatment

Significantly higher surface areas for PCACH were obtained with fluid bed calcining as compared to the rotary kiln. This material will be chlorinated to establish reaction rates.

c. Chlorination

A statistical analysis of chlorination results show that the reductant is the most significant variable affecting mass transfer rate. Increases in surface area of the pre-treated reductant should therefore increase kinetics.

d. Alcoa Technical Exchange

As a result of this meeting, we have forwarded small sample quantities of PCACH and PCPC to Alcoa labs for initial testing. We have also sent various samples of AlCl_3 to them for confirmatory C_xCl_y analyses.

R. Loutfy visited New Kensington on 21 September to discuss mass transfer coefficient measurements and Larry King will be in Tucson on 23 and 24 September to discuss costs.

REDUCTION RESEARCH

AD-108 Process

In depth discussions relating to the particulate anode concept were held with John Sibert and Jack Josefowicz of Corporate Technology. They have formulated a 6-8 month program to characterize the fundamental electrical characteristics of the particulate mixture. This work should determine the technical feasibility of the particle anode concept.

Anode formulation and electrolyte composition studies will be continued.

AD-119 Modified Electrolytes

A literature search has been completed and is being compiled to list the different influences of bath composition and operating conditions on performance. A new six inch test cell and furnace has been completed to avoid the competitive dual use of the composite anode test cell. Experimentation will continue using the new test cell set-up.

AD - 116 Pot Lining Resources Recovery

A concept for treating cathode waste, developed by Martin Marietta Aluminum Company, was reviewed and a report is forthcoming. Although the concept is interesting and potentially viable, it will not pass the "must" criteria for our potlining process evaluation because the process produces effluents that are environmentally unacceptable. Treatment of these streams in a manner similar to the AD - 116 process is possible, however.

Increased CF Pin Life

A literature search was completed on aluminum coating of steel to identify the best method and prospective properties of coating Columbia Falls Anode Pins. Several methods were identified such as ion-implanting, arc-spraying, ion-vapor deposition, electrodeposition, and hot dipping. The latter is considered to be the most economical and appropriate for the CF case, and will be further investigated.

Magnesium Processing

Exploratory work in new methods of producing Mg and/or anhydrous magnesium dichloride has been initiated. A literature search was completed. Articles and patents are on order. Our experimental effort will focus on assessing feasibility of producing anhydrous $MgCl_2$ via the chlorination of partially calcined magnesium hydroxide (analogous to the chlorination of PCACH) and on determining the potentials of electrolyzing Mg from MgO/C Composite (analogous to the Al_2O_3/C composite concept).

DEVELOPMENT & TECHNICAL SERVICES

Pot Magnetism - Columbia Falls

Plans are being made to obtain heat flux data on the modified bus cell. Paul Russell will take Tucson's heat flow meter to Columbia Falls and assist in making the measurements sometime in October.

Pot 304 experienced operating problems during the month. Bath temperature rose to over 1000°C. The set point voltage, which had been lowered to 4.43, was raised back to 4.60. At this time, the pot appears to be stabilizing.

Because of the operating problems, no magnetism data was taken. The plan is to take this data by the end of September.

Columbia Falls Anode Formulation Optimization

Laboratory work on the dry vibrated bulk density portion of the project (Phase I) was completed using ARCO coke. A measured maximum density of 1.24 g/cc was obtained. The normal Columbia Falls screen curve gave a density of 1.15 g/cc. This 0.09 g/cc increase in dry vibrated bulk density is encouraging because of the proven relationships between higher densities and improved anode performance. However, we cannot form any conclusions or make any comparisons to Mitsubishi technology until the whole coke-pitch system has been optimized with rheological considerations in Phase II of the project. Phase II is on hold until the petroleum pitch project is completed.

Continuous Cell Temperature Sensor

Loutfy and Russell visited I.I.T. in Chicago on September 20 to discuss materials and fabrication processes that may have applications in cell temperature measurement.

Corrosion testing of sample materials will begin at Tucson on September 27th. Si_2ON_2 , Si_3N_4 , AlN and vitreous carbon will be tested.

The plants and Tucson are interested in pursuing the method patented by Alcoa which monitors heat flux at the pot shell. Plans are being made to reproduce Alcoa's results.

Columbia Falls is interested in pursuing the Alusuisse patent and is proposing to perform some initial test work at Columbia Falls. Subject to approval, the test work would be performed on the ASV pot which has been modified to accept such a device.

Petroleum Pitch

Design and construction of the Soderberg-type bake furnace has been completed. The first anodes composed of ARCO coke and Reilly pitch have been produced and will form the basis for the Ashland A-240 petroleum pitch evaluation scheduled for completion in mid-October.

The air burn and CO₂ oxidation apparatus along with the anode consumption cell have been designed. Construction is expected to be completed in the first week of October.

Reduction Technology Workshop

The workshop will be held on September 23 and 24 at Sebree. Topics for discussion will include the use of point feeders and bus modifications at Columbia Falls, the large anode project at Sebree and the composite anode research at Tucson.

High Conductivity Cathode Block

Documentation of a canned heat transfer program is being purchased to evaluate its use as a base program for thermal modeling of the Sebree cathode. We have calculated the thermal profile of the cathode bottom using a simple one-directional method. Calculated results correspond very well to actual temperature measurements.

PERSONNEL

Louis Bartholme has accepted a position as Senior Technician in our Reduction Group. He was previously with Argonne Labs and will be reporting in about two weeks.



E. L. Cambridge

ELC:cbc

cc: R. W. Bartlett
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